

1 I CLAIM:

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3 1. Endothermic catalytic reaction apparatus
4 comprising:

5 a) a U-shaped flow through tubular reaction
6 chamber disposed upright within a combustion chamber,
7 and a catalyst contained within said reaction chamber
8 for the conversion of hydrocarbon to industrial gases
9 by reaction with steam; said reaction chamber having an
10 upper portion, and there being a convection chamber
11 extending about said upper portion to enhance the
12 transfer of heat from combustion products in the
13 reaction chamber, and

14 b) a radiant burner generally vertically
15 disposed within the combustion chamber and having a gas
16 permeable zone that promotes the flameless combustion
17 of fuel and oxidant supplied to said burner in order to
18 heat a metal fiber surface of the burner to
19 incandescence for radiating heat to the reaction
20 chamber; said radiant burner configured so that the
21 angle of radiation is predominantly incident upon the
22 surface of the tubular reaction chamber.

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1 2. The combination of claim 1 wherein said
2 tubular reaction chamber comprises a tube having outer
3 diameter or diameters ranging from about $\frac{3}{4}$ inch to
4 about 4 inches along the tube length.

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7 3. The combination of claim 1 wherein said
8 tubular reaction chamber is sized for creation of mass
9 velocities ranging from 400 lb/ft²/h to 1500 lb/ft²/h.

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12 4. The combination of claim 1 wherein said
13 catalyst in the tubular reaction chamber has average
14 catalyst particle diameters ranging from 1/8 to 1 inch
15 for producing gas pressure drops ranging from 1 psi to
16 8 psi during flow through the reaction chamber.

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19 5. The combination of claim 1 wherein said
20 tubular reaction chamber has a gas exit end temperature
21 ranging from 1150°F to 1400°F when heated by said
22 radiant burner, in operation.

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1 6. The combination of claim 1 wherein said
2 tubular reaction chamber has legs and an arc-shaped
3 bend connecting said legs, and said legs and bend have
4 maximum tube wall temperatures ranging from 1300°F to
5 1600°F when heated by said radiant burner, in
6 operation.

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9 7. The combination of claim 1 wherein said
10 tubular reaction has average heat fluxes ranging from
11 3,000 btu/ft²/h to 10,000 btu/ft²/h, when heated by
12 said radiant burner in operation.

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15 8. The combination of claim 1 wherein said
16 tubular reaction chamber is sized to have capacity to
17 generate hydrogen plus carbon monoxide product in
18 volumetric quantities ranging from 50 SCFH to between
19 500 and 1500 SCFH.

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22 9. The combination of claim 1 wherein said
23 radiant burner comprises a supported porous ceramic
24 material having extended life at operating temperatures
25 up to 2100°F.

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